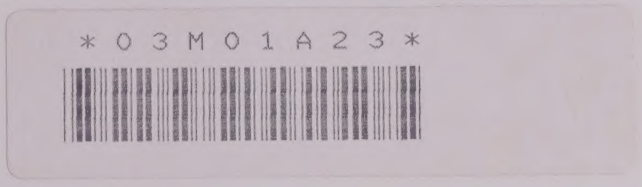
OPERATORS MANUAL



9008

AM/FM MODULATION METER

RACAL-DANA

RACAL

The Electronics Group

PUBLICATION NO. R-OM-9008
Issue 6.2.82

9008

AM/FM MODULATION METER

RACAL-DANA

RACAL-DANA INSTRUMENTS INC.
4 Goodyear Street, P.O. Box C-19541, Irvine, Ca 92713, USA.
Telephone: (714) 859-8999. TWX 910-595-1136. TLX 678-341

RACAL-DANA INSTRUMENTS LTD.
Duke Street, Windsor, Berkshire SL4 1SB, United Kingdom.
Telephone: Windsor (07535) 68101. TLX: 847013

RACAL-DANA INSTRUMENTS S.A.
18 Avenue Dutartre, 78150 Le Chesnay, France.
Telephone: (3) 955 88 88. TLX: 697 215

RACAL-DANA INSTRUMENTS GmbH.
Hermannstrasse 29, D-6078 Neu Isenburg, Federal Republic of Germany.
Telephone: 06102 2861/2. TLX: 412896

RACAL-DANA INSTRUMENTS ITALIA (srl)
Via Mecenate 84/A, 20138 Milano M1, Italy.
Telephone: (02) 5062767/5052686/503444. TLX: 315697

RACAL

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FOR YOUR SAFETY

Before undertaking any maintenance procedure, whether it be a specific troubleshooting or maintenance procedure described herein or an exploratory procedure aimed at determining whether there has been a malfunction, read the applicable section of this manual and note carefully the **WARNING** and **CAUTION** notices contained therein.

The equipment described in this manual contains voltage hazardous to human life and safety and which is capable of inflicting personal injury. The cautionary and warning notes are included in this manual to alert operator and maintenance personnel to the electrical hazards and thus prevent personal injury and damage to equipment.

If this instrument is to be powered from the AC line (mains) through an autotransformer (such as a Variac or equivalent) ensure that the common connector is connected to the neutral (earthed pole) of the power supply.

Before operating the unit ensure that the protective conductor (green wire) is connected to the ground (earth) protective conductor of the power outlet. Do not defeat the protective feature of the third protective conductor in the power cord by using a two conductor extension cord or a three-prong/two-prong adaptor.

Maintenance and calibration procedures contained in this manual sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures carefully and heed Warnings to avoid "live" circuit points to ensure your personal safety.

Before operating this instrument:

1. Ensure that the instrument is configured to operate on the voltage available at the power source. See Installation Section.

2. Ensure that the proper fuse is in place in the instrument for the power source on which the instrument is to be operated.

3. Ensure that all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If at any time the instrument:

- Fails to operate satisfactorily
- Shows visible damage
- Has been stored under unfavorable conditions
- Has sustained stress

It should not be used until its performance has been checked by qualified personnel.

AM/FM MODULATION METER 9008
OPERATORS HANDBOOK

AMENDMENTS

The following amendments are necessary to the 9008 Vol. 1 Operators Handbook to render it suitable for use with the 9008A version of the instrument.

PAGE CONTENTS (1)

CHAPTER 3	- delete 'REMOVAL OF COVERS 3-2'.

PAGE CONTENTS (2)

FITTING RACK MOUNTING KIT	- amend Part No. '11-1126' to read '11-1704'.

PAGE TECH. SPEC. (1)

Delete 'NOTE' and related text.

PAGE TECH. SPEC. (2)

AF Output, Level	- delete asterisk
AF Output, Harmonic Distortion	- delete asterisk and note.

PAGE TECH. SPEC. (4)

MECHANICAL, PHYSICAL	- amend Depth '268mm' to read '320mm'.
OPTIONS & ACCESSORIES	
Battery Pack	- amend Part No. '11-1148' to '11-1705'.
Carrying Case	- add '(Rigid)' after Case.
	- amend Part No. '15-0450' to '15-0747'.
	- amend Part no. '15-0435' to '15-0748'.
	- add new item 'Carrying Case (Soft) Part No. 15-0746'.
	- add new item 'Carrying Handle Kit Part No. 11-1730'.
	- add new item 'Remote Connector Kit Part No. 11-1372'.
	- add suffix 'A' to 9008 (2 positions).

PAGE TECH. SPEC. (6)

NOTE 4(a)	- delete '(a) Serial Numbers 1751 onward'.
4(b)	- delete entire note.

PAGE 1-1

Para 1.1	- add suffix 'A' to 9008 (1 position)

PAGE 1-3

Para 1.15(1)	- amend Part No. '11-01167' to '11-0167'.

PAGE 2-1

Para 2.1	- add suffix 'A' to 9008 (1 position)

PAGE 2-4

Para 2.9.1	- amend 'MAINS' to read 'LINE' (3 positions).
6	- delete asterisk.
	- delete asterisk and note below sub para. 6.

PAGE 2-5

Para 2.10 AF Output (BNC)	- delete asterisk.
	- delete asterisk and note at foot of page.

PAGE 2-6

Para 2.11	- amend 'MAINS' to 'LINE' (3 positions).
	- amend 'TABLE 1' to 'TABLE 5'.

PAGE 2-7

TABLE 5	- in BATTERY-MAINS Switch Position Column amend 'MAINS' to 'LINE' (3 positions).

PAGE 3-2

REMOVAL OF COVERS (Para 3.5)	- delete entire section.

PAGE 3-3

Delete (4),(5),(6), sub paras of para 3.5.
Para 3.6(1) - amend 'MAINS' to 'LINE' (3 positions).

PAGE 3-4

Para 3.7(1) - amend 'MAINS' to 'LINE' (1 position).
(2) - delete last sentence
Para 3.9 - delete 'Models with Serial Numbers 1751 onwards'.
Para 3.10 - delete.

PAGE 3-5

Para 3.11(1) - amend Part No. '11-1148' to '11-1705'.
(2) - delete.

PAGE 3-6

Para 3.12(11) - add suffix 'A' to 9008 (1 position).
(12) - amend 'MAINS' to 'LINE'.

PAGE 3-7

Remove existing Page 3-7 and insert new page 3-7.

PAGE REFERENCES

Amend all page references to read '9008A Vol. 1'.

RECORDING

Insert this amendment sheet at the rear of the Handbook for record purposes.

FITTING RACK MOUNTING KIT (OPTION) TYPE 11-1704

The kit comprises:

Rack Mounting ear extension	2	16-0645
M6 Captive Nut	4	24-2240
Washer Crinkle M4	4	24-2802
Washer Special M6	4	24-2809
Spacers 5mm Long	4	24-4112
Screw M4 x 16 Pan. Hd.	4	24-7733
Screw M6 x 16 Pan. Hd. Chrome	4	24-7995

Assemble the kit to the instrument as follows:-

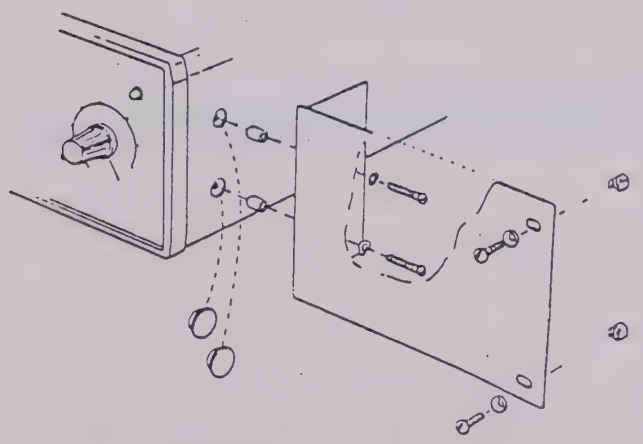
(1) Disconnect the AC power cord from rear panel.

(2) Remove 4 rubber bungs from sides of instrument (2 each side)

(3) Fit one Ear Extension to each side of the instrument using the four spacers, four Washers (24-2802), and four Screws (24-7733).

(4) Insert the instrument into the Rack and secure the Extension ends to the Rack, using four Chrome Screws (24-7995), four Washers (24-2809) and four Captive Nuts (24-2240).

Note: Support for the rear of the instrument is not required.



Rack Mounting 11-1704 Fig. 3.1

Modulation Meter 9008

CONTENTS

		Page No.
	FRONTISPIECE	
	TECHNICAL SPECIFICATION	Tech. Spec. (1) to (4)
	SUPPLEMENTARY DATA	Tech. Spec. (5)
CHAPTER 1	GENERAL DESCRIPTION	
	INTRODUCTION	1-1
	FACILITIES AND DISPLAY	1-1
	INPUTS AND OUTPUTS	1-1
	POWER SUPPLY	1-2
	AC Supply	1-2
	Battery Option	1-2
	Battery Charging	1-2
	Reversed Polarity Protection	1-3
	MAINTENANCE	1-3
	PROGRAMMING ACCESS	1-3
	OPTIONS AND ACCESSORIES	1-3
CHAPTER 2	BRIEF TECHNICAL DESCRIPTION	
	FUNCTIONAL PRINCIPLES	
	Introduction	2-1
	Sampling Mixer	2-1
	Theoretical Block Diagram (Fig. 2-1)	2-2
	Measurement Circuits	2-3
	DESCRIPTION OF CONTROLS AND INDICATORS	2-4
	REAR PANEL ITEMS	
	Rear Panel Connections	2-5
	Rear Panel Controls	2-6
	MAINS AND BATTERY POWER SELECTION	2-7
CHAPTER 3	PREPARATION FOR USE	
	POWER SUPPLY	
	Voltage Selection	3-1
	AC Fuse Check	3-2
	DC Fuses	3-2
	Power Lead	3-2
	REMOVAL OF COVERS	3-2

		Page No.
	INITIAL FUNCTIONAL CHECK	3-3
	BATTERY CHECK	3-4
	REMOTE PROGRAM FACILITIES	3-4
	BATTERY PACK FITTING INSTRUCTIONS	3-5
	FITTING RACK MOUNTING KIT 11-1126	3-7
CHAPTER 4	OPERATING INSTRUCTIONS	

LIST OF TABLES

Table No.		Page No.
1	Rear Panel 15-Way Connector PL4	Tech. Spec. (5)
2	Peak, Trough and Mean Remote Selection Logic	Tech. Spec. (5)
3	Logic Levels	Tech. Spec. (5)
4	Meter Range Program	Tech. Spec. (6)
5	Mains and Battery Power Selection	2-7
6	Mains Voltage Selection	3-1

TECHNICAL SPECIFICATION

NOTE: This data refers to instrument serial numbers commencing at 1751. For serial numbers 1701 to 1750 refer to Issue 1 of the handbook.

INPUT CHARACTERISTICS

Carrier frequency range:	1.5 MHz to 2 GHz.
Input level:	Low input: 5 to 100 mV r.m.s. up to 500 MHz. 10 to 150 mV r.m.s. from 500 MHz to 1 GHz. 20 to 150 mV r.m.s. from 1 GHz to 2GHz. High input: 50 mV to 1V r.m.s. up to 500 MHz. 150 mV to 1V r.m.s. from 500 MHz to 2 GHz.
Level setting:	Fully automatic.
Input impedance:	50Ω nominal.

FM MEASUREMENT

Deviation ranges:	1.5, 3, 5, 10, 15, 30, 50 and 100 kHz peak deviation f.s.d. Measurements of positive, negative and mean deviation can be made.
Modulation frequency range:	50 Hz to 30 kHz.
Accuracy:	±2% of f.s.d. ±1% of reading at 1 kHz.
Frequency response:	(1) ±0.2 dB with respect to 1 kHz from 300 Hz to 3 kHz. (2) ±0.5 dB with respect to 1 kHz from 50 Hz to 30 kHz.
Residual f.m. noise:	-52 dB with respect to 10 kHz peak deviation measured on the AF output, with the 3 kHz filter in, at carrier frequencies up to 250 MHz then increasing at 6 dB per octave above this frequency.

AM rejection:	Additional deviation error is less than 250 Hz with an a.m. depth of up to 80% and a modulating frequency in the range 300 Hz to 3 kHz.

AM MEASUREMENT

Modulation depth ranges:	5, 10, 15, 30, 50 and 100% f.s.d. modulation depth. Measurements of peak, trough or mean amplitude relative to carrier may be measured.
Modulation frequency:	50 Hz to 30 kHz.
Accuracy:	±2% of f.s.d. ±1% of reading at 1 kHz.
Frequency response:	(1) ±0.2 dB with respect to 1 kHz from 300 Hz to 3 kHz. (2) ±0.5 dB with respect to 1 kHz from 50 Hz to 30 kHz.
Residual a.m.:	Less than 1% for inputs greater than 10 mV r.m.s.

IF OUTPUT

Frequency:	430 kHz nominal.
Level:	100 mV r.m.s. e.m.f. ±2 dB.
Output impedance:	600Ω nominal.

AF OUTPUT

Response:	(1) Normal: ±0.5 dB over the frequency range 50 Hz to 30kHz. (2) Filter in: 300 Hz to 3 kHz at 3 dB points.
Level:	1V* r.m.s. e.m.f. ±2dB at meter f.s.d. (10 scale).
Output impedance:	600Ω nominal.
Harmonic distortion:	FM: Less than 0.5% for f.m. deviations up to 100 kHz. AM: Less than 1%, typically 0.5% for a.m. depths up to 80%. *200mV r.m.s. in Serial No's below 2001.

DC OUTPUT

Level:	1V e.m.f. ±0.5 dB at meter f.s.d. (10 scale).
Output impedance:	10 kΩ nominal.

REMOTE CONTROL

Functions selectable:	AM or FM Meter range Filter In/Out Peak, Trough and Mean (AM) Positive, negative or mean peak deviation (FM).
Control signals:	Parallel input (1) Logic '0', 0V to +0.5V or open circuit. (2) Logic '1', +3V to +7V.
Input impedance:	3.3 kΩ minimum.
Other inputs:	Positive and negative d.c. power supply inputs (12V to 20V).
Outputs:	(1) d.c. output 1V e.m.f. ±0.5 dB at meter f.s.d. (2) Lock signal.

POWER REQUIREMENTS

AC mains operation:	Voltage 94V to 130V 188V to 260V Frequency 45 to 440 Hz Consumption approximately 15VA.
External d.c. supply:	12V to 20V positive and negative (which must be fitted with 500 mA fuses at source).
Optional battery pack:	Rechargeable nickel-cadmium cells.

ENVIRONMENTAL & SAFETY SPECIFICATIONS

Operating temperature:	0°C to +55°C (0° to +40°C with battery pack).
Storage temperature:	-40°C to +70°C (-40°C to +50°C with battery pack).
Mechanical:	In accordance with IEC 68 and British Joint Services Specification REMC/20/FR/CAT.III.
Safety:	Designed to meet IEC 348 (BS 4743).

MECHANICAL

Physical:

Height	Width	Depth
96.5 mm	240 mm	268 mm

Weight: approximately 3.2 kg (5.2 kg with battery pack).

OPTIONS AND ACCESSORIES

Battery pack: (Part No.11-1148)	Rechargeable Nickel-Cadmium cells give a minimum 6 hours continuous operation. The charger in the 9008 enables cells to be trickle charged during normal mains operation. A discharged battery can be fully charged in approximately 14 hours by setting the power switch to OFF/CHARGE.
Carrying case: (Part No. 15-0450 for standard instrument, or Part No. 15-0435 for battery operated instrument).	A robust carrying case is offered as an option, which will enable the instrument to be carried by a shoulder strap.
Coupling unit: (Part No.11-0167)	An RF Coupling Unit enables measurements to be made on high power transmitter signals without direct connection.
Antenna: (Part No.23-9020)	A telescopic antenna is available for use in suitable conditions.

SUPPLEMENTARY DATA

TABLE 1

Rear Panel 15-Way Connector PL4

(See Notes on following page)

Pin	Facility	Program Control Logic	
		'0'	'1'
1	AM/FM Select	FM	AM
2	Filter Select	Filter OUT	Filter IN
3	Peak (+) Select) See Table 2 below		
4	Trough (-) Select)		
5	6 dB Select) Range selection	Not Selected	Selected
6	10 dB Select) (see NOTE 6)	Not Selected	Selected
7	20 dB Select)	Not Selected	Selected
8	D.C. (analogue) output (NOTE 1)		
9	"In Lock" indication (NOTE 2)		
10	Battery Check input (NOTE 3)		
11	See NOTE 4		
12	+ve Battery in/charge (NOTE 5)		
13	Common earth (0V)		
14	-ve Battery in/charge		
15	Mute for "Battery Check" (NOTE 5)		

TABLE 2

Peak, Trough and Mean Remote Selection Logic

PL4 pin 3 (PEAK)	PL4 pin 4 (TROUGH)	Function
0	0	No function
1	0	PEAK
0	1	TROUGH
1	1	MEAN

TABLE 3

Logic Levels
(except Pin 11)

'0'	'1'
Open Circuit or < +0.5V	Between +3V and +7V

NOTES ON TABLE 1

1. DC (Analogue) Output (pin 8). This output is identical to that at the BNC DC output socket on the rear panel.

2. In Lock Indication. This output is a steady logic level. Logic '1' signal for "in lock", a '0' signal for "out of lock". The output is TTL but can drive only a single load.

3. Pin 10 Battery Check Input. This pin feeds the battery voltage to the front panel meter when the appropriate monitor switch on the battery pack is pressed.

4. (a) Serial Numbers 1751 onwards: pin 11 is not used.

   (b) Serial Numbers 1701 to 1750: a voltage of not less than +10V applied to pin 11 will select remote program control. Refer to Chapter 3 para. 3.10.

5. Pin 15. This line isolates the meter from modulation information whilst in use on battery check.

6. Meter Range Selection. The eight measurement ranges are obtained by programming pins 5, 6 and 7 in accordance with Table 4.

TABLE 4

Meter Range Program

Program		Meter Scale	Program		Meter Scale
0 dB	=	1.5	20 dB	=	15
6 dB	=	3	20+6 dB	=	30
10 dB	=	5	20+10 dB	=	50
10+6 dB	=	10	20+10+6 dB	=	100

7. The mating socket for PL4 is a Cinch type 43/81/046, Racal-Dana part number 23-3118, with shell, Racal-Dana part number 23-3120.

CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1.1 The Racal Modulation Meter 9008 provides a simple and unambiguous method of measuring the modulation depth of a.m. signals and the peak deviation of f.m. signals. A feature of the instrument is the entirely automatic tuning and level setting, which operates over the entire range of 1.5 MHz to 2 GHz and is available by either local control or remote program.

FACILITIES AND DISPLAY

1.2 Measurements of peak deviation in eight ranges and modulation depth in six ranges are clearly displayed on a meter. A divide-by-two Meter Range switch enables readings always to be taken in the upper half of the meter scale where measurement is more accurate. A switched AF Filter is provided for use in conditions of high signal noise. An Out of Lock indicator flashes if the input signal is outside the specified amplitude or frequency limits.

1.3 AM or FM operation is selected by a three-position Function switch which includes a position for level indication. When LEVEL is selected, the panel meter indicates the approximate input signal amplitude. This is particularly useful if the lock lamp flashes due to incorrect signal amplitude, as it enables the user to determine immediately whether the signal is above or below the level required and to take the necessary corrective action. This facility is also useful when tuning a transmitter under test.

1.4 Another three-position switch permits measurement of peak and trough amplitudes on AM and positive and negative deviation on FM. In the third position the mean of the modulation depth or the mean of the peak frequency deviation can be measured. Local or Remote control is selected by a front panel switch.

INPUTS AND OUTPUTS

1.5 Two signal input sockets are provided on the front panel, each terminated in 50 Ω. The 'low' input is for signal levels between $\mathcal{E}$ mV and 150 mV r.m.s. The 'high' input is for signals between 50 mV and 1V r.m.s. The sensitivities at different portions of the frequency spectrum are given in Chapter 4 (Operating).

1.6 On the rear panel, the i.f., the demodulated a.f. and a d.c. (analogue) output equivalent to the meter reading, are available at BNC sockets. These can be monitored by oscilloscope or other measuring equipment. The a.f. output is notable for a very low level of harmonic distortion, thus permitting realistic measurement of modulation distortion by means of a suitable Wave Analyser.

1.7 Other rear panel connectors are the a.c. mains plug and a multiway socket for remote program and external battery connections.

POWER SUPPLY

AC Supply

1.8 The instrument operates from nominal 110V or 220V a.c. supplies, 45 to 440 Hz. Mains voltage selection is by means of two rear panel switches which provide four possible voltage selections and can be locked to the chosen positions. Refer to page 3-1, Table 6.

Battery Option

1.9 An optional battery pack containing re-chargeable nickel cadmium cells can be attached to the underside cover of the instrument and connected via the multiway rear panel connector. A rear panel switch selects the battery or mains operation, as required. The battery pack has a battery check facility. Instructions for fitting the battery pack are given in Chapter 3.

Battery Charging

1.10 With the battery pack fitted, and the instrument connected to the mains supply, the internal power circuit will function as a battery charger which provides a trickle charge when operating as a mains powered instrument and a full charge facility when the POWER switch is set to OFF/CHARGE. A fully charged battery will give 6 hours operation at approximately +20°C ambient temperature. Refer to Table 5 on page 2-7 for a summary of the mains and battery power switching.

NOTE (1) To fully charge a discharged battery requires 14 hours.

(2) Avoid overcharging, as it will progressively reduce battery charge capacity.

(3) When the instrument is operating from a.c. mains supply the batteries receive a trickle charge which can continue indefinitely without detriment to the batteries.

Reversed Polarity Protection

1.11 If the batteries are inadvertently connected with reversed polarity, the 500 mA fuses in the battery pack will rupture. A customer fitting an external d.c. supply must fit a 500 mA fuse in each +10V and -10V line to ensure reversed polarity protection.

MAINTENANCE

1.12 The customer is recommended to take advantage of the servicing facilities offered by Racal-Dana Instruments Ltd., and agents. A comprehensive Maintenance Manual is, however, available for purchase.

PROGRAMMING ACCESS

1.13 The 15-way socket fitted to the rear panel gives access to the logic circuits controlling the selection of the following functions:-

AM or FM Mode:
AF Filter in/out:
Meter Range:
Peak, Trough and Mean (AM):
Positive, Negative or Mean peak deviation
Details of logic levels will be found on page Tech. Spec. (5).

OPTIONS AND ACCESSORIES

Options

1.14	(1)	Battery Pack:	refer to paragraphs 1.9 and 1.10.
	(2)	Carrying Case:	a robust case with shoulder strap.

Accessories Available to Order

1.15	(1)	RF Coupling Unit:	the Coupling Unit (Part No. 11-01167) enables measurement to be made on high powered transmitters without direct connection and with adjustable coupling.
	(2)	Telescopic Antenna:	this wideband antenna can be plugged into the appropriate input socket. It is suitable for use only where there is no risk of receiving false or interfering signals which could lead to misleading readings.

CHAPTER 2

BRIEF TECHNICAL DESCRIPTION

FUNCTIONAL PRINCIPLES

Introduction

2.1 The 9008 dispenses with the tedious tuning and level setting procedures of conventional modulation meters by exploiting the principle of the Sampling Mixer, combined with a frequency-locked loop controlling a local oscillator. The principle of this part of the instrument is illustrated in Figure 2.1 on the following page.

Sampling Mixer

2.2 Referring to Fig. 2.1, the divided output from the voltage controlled oscillator 'A' drives a pulse generator 'B', thus producing a train of narrow pulses (fs) which are applied to an input of the Sampling Mixer 'C'. The external signal (fi) which is applied to the other input of the mixer, is sampled by this pulse train. If a harmonic of the sampling frequency 'fs' is identical in frequency to the external signal, the output frequency from the sampling mixer (the i.f.) will be zero. When the two frequencies are not identical a 'difference' frequency output will be obtained.

2.3 The frequency relationship can be expressed by the formula:-

$$i.f. = (N.fs - fi)$$

where N.fs is that harmonic of fs closest to the external signal fi.

2.4 It is the function of the control loop to sweep the oscillator (and hence the sampling frequency) until the required difference frequency (the i.f.) is obtained at the sampler output. The oscillator frequency is then held at this point.

'In Lock Indication'

2.5 The IN LOCK lamp is driven by a multivibrator which has two primary control lines. The multivibrator will run and cause the 'IN LOCK' lamp to flash until the required conditions on the control lines are satisfied. Measurements are not valid until the flashing indication is replaced by a steady illumination.

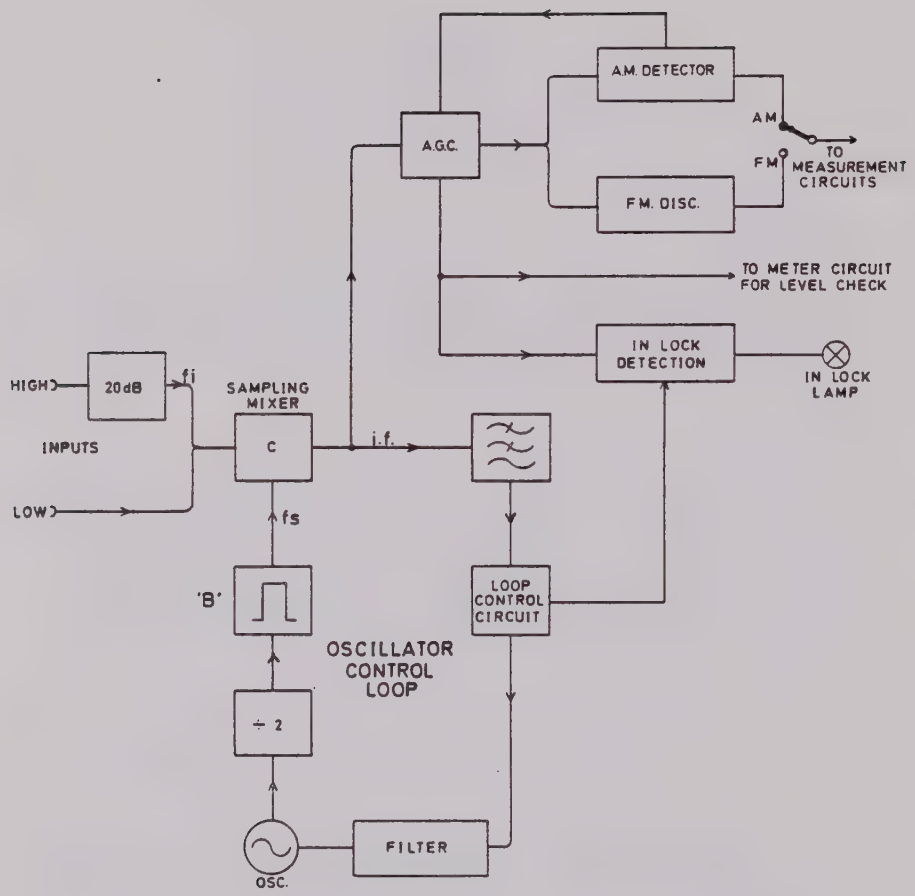


Fig. 2.1 Theoretical Block Diagram

2.6 The conditions which can cause the IN LOCK lamp to flash are:-

(a) Input frequency out of range.

(b) Input signal level too high or too low. (Use LEVEL position of Function switch to determine whether amplitude is within specified range).

(c) Modulation in excess of the specified maxima (100 kHz deviation or 100% AM).

Measurement Circuits

2.7 AM Modulation Depth. An automatic level control circuit ensures a constant i.f. level into the detector. By virtue of this constant level the absolute value of the detected audio signal can provide a measurement of percentage modulation depth. This measurement is displayed on the meter. A 'peak-mean-trough' switch permits measurement of both positive and negative peaks of the modulating waveforms, as well as the mean modulation depth. (See NOTE below).

2.8 FM Deviation. For FM measurements the signal (i.f.) is applied to a 'pulse' discriminator which has an output level proportional to frequency. The amplitude of this output waveform has a mean level which corresponds to the i.f. Variations from this level represent positive and negative peak deviations. These variations are 'peak and trough' detected and displayed as a meter reading. The outputs of the peak and trough detectors are combined in the MEAN position of the switch to give a mean deviation indication.

NOTE: The term "mean modulation" in this instrument is defined as:-

$$\frac{\text{Peak Reading} + \text{Trough Reading}}{2}$$

DESCRIPTION OF CONTROLS AND INDICATORS

2.9

1.	POWER ON/OFF CHARGE switch	The switch function depends on the setting of the rear panel, BATTERY/MAINS switch, as follows:- 'AC Only' Instrument With MAINS selected the POWER switch provides on/off switching of the rectified a.c. supply in the internal power unit. AC and Battery Instrument Table 5 on page 2-7 summarizes the relationship between the POWER switch, the BATTERY/MAINS switch and the alternative mains or battery power sources.
2.	AM/LEVEL/FM switch	This switch connects the measurement circuits to the appropriate AM or FM signal path. The LEVEL position gives an approximate logarithmic meter reading of the input signal level.
3.	METER RANGE (lever) switch	Selects the appropriate peak deviation or modulation depth range to provide suitable meter deflections. The range markings are colour coded to match the corresponding scales on the meter.
4.	METER RANGE (toggle) switch	This switch is used in conjunction with the Meter Range lever switch and effectively doubles the length of the meter scale. It allows all readings, except those of the lowest range, to be displayed in the upper half of the scale.
5.	AF FILTER switch	When switched to the IN position it restricts the AF bandwidth to 300 Hz - 3 kHz at the 3 dB points.
6.	LOCAL/REMOTE switch*	Selects local operation, or control by remote program via the rear panel 15-way connector.

* Fitted from serial number 1751 onwards.

7. PEAK/MEAN/TROUGH switch

This switch selects the Peak detector or the Trough detector, thus enabling measurements to be made on either peak or trough of an a.m. signal, or positive or negative peak deviations of an f.m. signal. In the MEAN position the peak and trough measurements are averaged.

8. IN LOCK Indicator lamp

With POWER switch to ON this lamp will flash until the instrument has locked to the input signal, when it will display a steady illumination.

9. MAINS ON Indicator lamp

This lamp illuminates in both positions of the POWER switch whilst a.c. power is connected.

10. Input sockets (BNC)

Input (high): 1V max, 50 ohm impedance.

Input (low): 150mV max, 50 ohm impedance.

NOTE: The absolute maximum input level is 3V r.m.s. on both inputs.

The symbol ⚠ on the front panel advises the user to consult the handbook for precise input level details. See Chapter 4.

REAR PANEL ITEMS

2.10 Rear Panel Connections

IF Output (BNC)

430kHz nominal output.
100mV r.m.s. e.m.f. nominal.
Output impedance 600 ohm.

AF Output (BNC)

Output level 1V* r.m.s. e.m.f. (nominal) at f.s.d. (10 scale). Output impedance 600Ω.

DC Output (BNC)

Provides analogue output proportional to meter reading.
Output level 1V e.m.f. (nominal) at f.s.d. (10 scale)
Output impedance 10kΩnominal.

*AF Output 200mV r.m.s. in Serial No's below 2001.

Multiway Connector

Provides for remote program connections and an input point for an external battery supply. Refer to page Tech. Spec. (5) Table 1.

Mains (AC) Input Plug

A fixed 3-pin plug. A three core supply cable is supplied with the instrument for the mains connection.

2.11 Rear Panel Controls

Voltage Selector Switches

Two lockable slide switches permit four possible voltage selections as follows:-

94V to 110V	188V to 220V
110V to 130V	220V to 260V

The switches must be secured by a screwed locking plate after the correct voltage range has been selected. Refer to para. 3.1.

BATTERY/MAINS Switch

This switch will be operated in the MAINS position except when "Battery" operation is required. Table 1 below summarizes the operational combinations of the POWER and BATTERY/MAINS switches together with the alternative power connections, assuming that batteries are fitted.

BATTERY CHECK Switch

2.12

The optional battery pack is fitted with a non-locking toggle switch by which the battery voltage can be monitored using the battery check markings on the meter scale. A reading to the right of the line marked thus (-|-) is satisfactory.

TABLE 5

Mains and Battery Power Selection

		Mains Plug and Battery Connection State and Operational Condition			
POWER ON/ OFF Switch Position	BATTERY-MAINS Switch Position	Mains "In" Battery "In"	Mains "out" Battery "In"	Mains "In" Battery "out"	Mains "out" Battery "out"
ON	MAINS	Operates from mains: battery trickle charged.	No operation.	Operates from mains.	No operation.
OFF - CHARGE	MAINS	No operation. Batteries on full charge.	No operation.	No operation.	No operation.
ON	BATTERY	Operates from batteries.	Operates from batteries.	No operation.	No operation.
OFF - CHARGE	BATTERY	No operation. Batteries on full charge.	No operation.	No operation.	No operation.

CHAPTER 3

PREPARATION FOR USE

POWER SUPPLY

Voltage Selection

3.1 Mains voltage selection is by two rear panel slide switches S6 and S7 with locking plate. Proceed as follows:-

(1) On the rear panel extract the two screws securing the cut-away locking plate and remove the plate. The switch markings S6 and S7 will then be visible.

(2) Refer to Table 6 below and set the slide switches S6 and S7 to the positions for the required voltage range.

(3) Ease the plate over the slide switches such as to align the screw holes. Secure the plate with the two screws previously removed.

(4) Verify that the cut-away in the plate allows the required voltage marking to be seen.

TABLE 6

Mains Voltage Selection

Switch Settings		Instrument Voltage Range For Local A.C. Supply
S6	S7	
Up	Down	94V to 110V
Up	Up	110V to 130V
Down	Down	188V to 220V
Down	Up	220V to 260V

AC Fuse Check

3.2 Check that the power fuse on the rear panel has the correct rating for the supply voltage, as follows:-

188V to 260V supply	80 mA	)	antisurge fuse
94V to 130V supply	160 mA	)	must be used

There are no internal fuses.

DC Fuses

3.3 The optional battery pack has a 500 mA fuse in each line (+10V and -10V).

IMPORTANT NOTE:

If a d.c. supply is provided by the customer it is essential that it be fitted with 500 mA fuses (normal quick action type) in the respective +10V and -10V lines, to ensure reversed polarity protection.

Power Lead

3.4 Fit a suitable plug to the power lead supplied, in accordance with the standard colour code:-

Brown ..... Line
Blue ..... Neutral
Green/Yellow ..... Earth (Ground)

REMOVAL OF COVERS

NOTE: The procedure for removal of top and bottom covers is identical except that the bottom cover has four securing screws and the top cover has none.

3.5 (1) Switch the instrument POWER switch to OFF/CHARGE and switch off the a.c. supply at the bench outlet. Unplug the power lead from the rear panel of the instrument.

(2) If the bottom cover is to be detached, remove the four screws from this cover.

(3) Remove the rubber plugs (located near to the rear end) from both side panels of the instrument and slacken, by about two turns, the screws revealed.

(4) Grip the rear panel assembly and ease it back from the main case to the maximum extent available (about 5 mm).

(5) The rear edge of either cover can now be lifted and the cover withdrawn outwards and rearwards.

(6) To replace the covers reverse the above procedure.

INITIAL FUNCTIONAL CHECK

NOTE: For a battery powered instrument refer to para. 3.7 for the power supply check.

3.6 (1) Set the rear BATTERY/MAINS switch to MAINS, connect the power supply and check that the MAINS ON indicator illuminates.

(2) Set the POWER switch to ON.

(3) Set the FUNCTION switch to AM.

(4) Verify that the IN LOCK lamp is flashing.

(5) Apply a suitable a.m. signal, within the operating frequency range, to the appropriate input socket.

(6) Check that the IN LOCK lamp changes to a steady illumination. If it fails to do so check that:-

(a) That the input frequency is within the operating range.

(b) Input signal amplitude is within the specification range for the input socket in use. Set the Function switch to the LEVEL position to determine whether the amplitude is too high or low, as follows:-

(i) 100 mV input corresponds to approximately 8 on the meter 10 scale.
(ii) 5 mV input corresponds to approximately 2 on the meter 10 scale.

(c) Check that modulation is within the specified range.

(7) Verify that the meter reading is correct for the signal applied.

(8) Select FM on the FUNCTION switch.

(9) Repeat (6) and (7) with an f.m. signal input.

BATTERY CHECK

3.7 (1) If the optional battery pack is fitted, disconnect the a.c. supply and set the BATTERY/MAINS switch to BATTERY.

(2) Operate the Check switch on the battery pack and at the same time verify that the meter reading is not below the battery check mark. (The green band on models with serial numbers 1701 - 1750).

(3) If the batteries have not been in recent use it is recommended that the battery check be repeated after about 5 minutes operation, to ensure that the voltage is being maintained.

(4) To re-charge, connect up the a.c. supply and set the POWER switch to OFF/CHARGE. The full charging period is approximately 14 hours. In the interests of long battery life overcharging should be avoided.

REMOTE PROGRAM FACILITIES

3.8 Remote program connections are made via the 15-way rear connector PL4. The pin functions are listed in Table 1 and logic data in Tables 2 and 3 on page Tech. Spec. (5). Notes on the various facilities are given after the tables.

Remote/Local Changeover

3.9 Models With Serial Numbers 1751 Onwards

A LOCAL/REMOTE changeover switch is provided on the front panel.

3.10 Models With Serial Numbers 1701 to 1750

To select 'remote' operation a voltage of not less than +10V must be applied to pin 11 of the rear connector PL4; a suitable voltage is provided at pin 12. To revert to full 'local' control a logic '0' (or open circuit) must be applied to all relevant control lines on PL4. The simplest procedure is to remove the 15-way free connector, unless the instrument is receiving d.c. power via this connector.

BATTERY PACK FITTING INSTRUCTIONS

Items Supplied

3.11 (1) Optional Battery Pack Kit (Part No. 11-1148).

(2) 27 kΩ resistor. (required only for instrument serial numbers 1701-1750)

Fitting Procedure

3.12 (1) Fit the battery pack externally to the bottom cover of the instrument as follows.

(2) Switch off and disconnect the a.c. power supply.

(3) Place the instrument on the bench with bottom cover uppermost.

(4) Remove the caps from the four plastic feet on the bottom cover of the instrument, then, using a Pozidriv screwdriver, unscrew and discard the four feet.

(5) Remove the cover from the battery pack after first removing the nut and decorative washer from the toggle switch. Take care not to short-circuit the batteries, which may be charged.

(6) Remove the four M4 nuts securing the pillars to the battery pack chassis, and discard these nuts.

(7) Place the battery pack chassis on the bottom cover of the instrument with batteries uppermost and the switch facing to the front of the unit.

(8) Align the holes in the battery pack chassis with the four holes in the instrument cover and screw the pillars (with M4 plain and crinkle washers) through the chassis holes into the bottom cover, thus securing the battery pack to the cover.

(9) Fit the battery pack cover by passing the hole in the front of the cover over the toggle switch and then fit the M3 screws, with crinkle washers, into the four pillars and make secure.

(10) Refit the decorative washer and nut on to the toggle switch and lightly tighten.

(11) Plug the battery pack lead into the 15-way rear panel connector of the 9008.

(12) Set the rear panel BATTERY/MAINS switch to BATTERY and check the instrument on battery power. Charge the batteries if necessary.

FITTING RACK MOUNTING KIT (OPTION) TYPE 11-1126

(1) Remove the bench type handle assembly by carefully prising off the plastic caps from the handle pivots, and then extracting the screws which secure the assembly to the unit. Store safely for possible future use.

(2) Remove the rubber bungs referred to in 'removal of covers' procedure and completely remove the two screws revealed. This allows the rear panel to be drawn away from the side panels (as far as wiring permits).

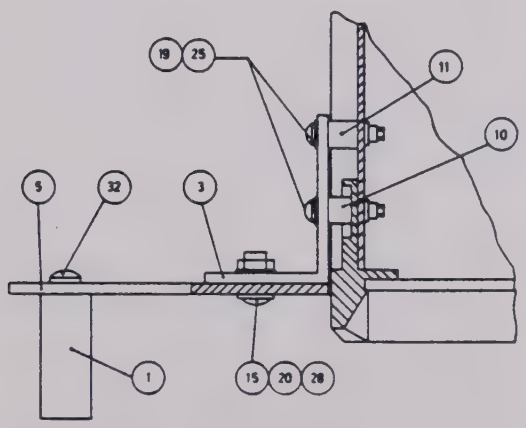
(3) With the rear panel drawn backwards, slide out the trim strips from the side panels. Store them safely for possible future use. Then refit the rear panel and secure firmly with the two screws removed in (2).

(4) At the front of the instrument, remove the screw securing the front panel on one side and discard. Refer to diagram below and fit bracket (item 3) using spacers (items 10 and 11) screws (item 25) and washers (item 19).

(5) Repeat (4) on the other side of the front panel.

(6) Fit the rack type handles (item 1) to the plates (item 5) using two Taptite screws (item 32) to each handle.

(7) Fit the plate assemblies to brackets on the unit, using two of items 15, 20 and 28 to each plate assembly.



Plan View: Rack Mounting 11-1126 Fig.3.1

CHAPTER 4

OPERATING INSTRUCTIONS

NOTE: The instrument should have been prepared for use as described in Chapter 3.

AUTOMATIC OPERATION

4.1 (1) Set the controls as follows:-

(i) POWER switch to ON. LOCAL/REMOTE switch to LOCAL.

(ii) FUNCTION switch to AM or FM as required.

(iii) AF FILTER switch to OUT

(iv) PEAK/MEAN/TROUGH switch, as required.

(v) The two-position METER RANGE switch to the 3-100 position.

(vi) The METER RANGE lever switch to the 100/50 position.

(2) Connect the signal to be checked to the appropriate INPUT socket. If the amplitude is not known use the 1V r.m.s. socket initially.

(3) The IN LOCK lamp should show a steady illumination, if it continues to flash the cause is likely to be one of the following:-

(a) Signal frequency outside the specified operating range (1.5 MHz - 2 GHz).

(b) Modulation in excess of the specified ranges (AM or FM).

(c) Signal level too high or too low. (Use the LEVEL position of the Function switch to check the input level, see para. 3.6 (6)). Check that the appropriate input socket is connected. The input characteristics over the frequency range are as follows:-

Low Input Socket	High Input Socket
5 - 100 mV r.m.s. up to 500 MHz	50 mV - 1V r.m.s. up to 500 MHz
10 - 150 mV r.m.s. from 500 MHz to 1 GHz	150 mV - 1V r.m.s. from 500 MHz
20 - 150 mV from 1 GHz to 2 GHz	to 2 GHz.

(4) A meter reading may be taken when the IN LOCK lamp gives a steady illumination. Set the METER RANGE switches to give the most convenient indication on the meter scale. Under noisy signal conditions the AF FILTER may be switched to IN.

(5) Read the measurement from the appropriate scale on the meter, according to the settings of the METER RANGE switches.

RACAL-DANA Instruments Inc.

U. S. REPRESENTATIVES

ALABAMA
(703) 941-0525

ALASKA
(503) 283-0132

ARIZONA
(602) 252-5242

ARKANSAS
(918) 496-1457

CALIFORNIA
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NEW HAMPSHIRE
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Southern
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Upstate New York
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CANADA
Ontario
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Quebec
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British Columbia
(604) 430-1410
Ottawa
(613) 726-8888
Montreal
(514) 336-0392

RACAL-DANA Instruments Inc.

U. S. AND CANADIAN SERVICE CENTERS

FACTORY SERVICE

RACAL-DANA INSTRUMENTS INC.
4 Goodyear Street
Irvine, California 92718
Telephone: (714) 859-8999

PRODUCT SERVICE TWX 910-595-1136

REGIONAL SERVICE CENTER

RACAL-DANA INSTRUMENTS INC.
5101 "D" Blacklick Road
Annandale, Virginia 22003
Telephone: (703) 941-0525

INTERNATIONAL SERVICE CENTERS

RACAL-DANA INSTRUMENTS LTD.

Duke Street, Windsor,
Berkshire SL4 1SB, United Kingdom
Telephone: Windsor (0753) 868101, TLX: 847013

RACAL-DANA INSTRUMENTS GmbH.

Hermannstrasse 29, D-6078 Neu Isenburg,
Federal Republic of Germany
Telephone: 06102-2861/2, TLX: 412896

RACAL-DANA INSTRUMENTS S.A.

18 Avenue Dutartre, 78150 Le Chesnay, France
Telephone: (1) 3-955-8888, TLX: 697 215

RACAL-DANA INSTRUMENTS ITALIA srl.

Via Mecenate 84/A, 20138 Milano MI, Italy
Telephone: (02) 5062767/5062686, TLX: 315697

REPAIR REQUEST FORM

To allow us to better understand your repair requests, we suggest you use the following outline and include a copy with your instrument to be sent to your local Racal-Dana repair facility.

Model Number _____ Options _____ Date _____

Serial Number _____ P. O.# _____

Company Name _____

Address _____

City _____ State _____ Zip Code _____

Contact _____ Phone Number _____

1. Describe, in detail, the problem and symptoms you are having.

_____

_____

2. If you are using your unit on the bus, please list the program strings used and the controller type, if possible.

_____

_____

3. List all input levels, and frequencies this failure occurs.

_____

_____

4. Indicate any repair work previously performed.

_____

_____

5. Please give any additional information you feel would be beneficial in facilitating a faster repair time. (I. E., modifications, etc.)

_____

_____

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